SOLID AND HAZARDOUS WASTE MANAGEMENT SECTION
MEMORANDUM

TO: Karen G. J'Anthony, Program Manager I, SHWMS KGJ'A 12/04/2014

FROM: Melissa A. Ferree, Engineer III, SHWMS MAF 12/4/14

DATE: December 4, 2014

SUBJECT: Bloom Energy – Desulfurization Containers

REFERENCE: Bloom Energy

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CONCLUSION:

The desulfurization containers in use by Bloom Energy do not meet the requirements of the manufacturing process unit exemption and thus, the spent sorbents contained within the desulfurization containers are hazardous waste. As such, Bloom has incurred violations of Delaware's hazardous waste requirements for improper management of hazardous waste.

BACKGROUND:

Bloom Energy utilizes desulfurization canisters to remove impurities in natural gas prior to utilizing the natural gas to create electricity in a solid oxide fuel cell. The desulfurization canister contains a sorbent material consisting of carbon, metal oxides, and Zeolites. Natural gas flows through the sorbent material, allowing sulfur and other contaminants to adsorb to the sorbent material. When the sorbent can no longer remove contaminants, the desulfurization container is removed from the fuel cell module and the container is shipped via common carrier to Unicat Services, LLC in Alvin, Texas. Bloom Energy claims the desulfurization containers meet the manufacturing process unit exemption in 7 DE Admin. Code 1302, Delaware's *Regulations Governing Hazardous Waste* (DRGHW) § 261.4(c) and as such, the waste is not regulated until it is removed from the desulfurization canister in Texas.

DISCUSSION:

The SHWMS inquired with Bloom Energy regarding the management of spent sorbents from the desulfurization containers on July 11, 2014. The SHWMS followed up with information request letters dated August 20, 2014 and October 14, 2014. In its September 9, 2014 letter, Bloom states that while the spent desulfurization waste is ultimately considered hazardous waste for arsenic (D004), chromium (D007), lead (D008), and benzene (D018) content, the waste is exempt while in Delaware due to the manufacturing process unit exemption [DRGHW § 261.4(c)], which reads:

> *"Hazardous wastes which are exempted from certain regulations. A hazardous waste which is generated in a product or raw material storage tank, a product or raw material transport vehicle or vessel, a product or raw material pipeline, or in a manufacturing process unit or an associated non-waste-treatment-manufacturing unit, is not subject to regulation under Parts 262 through 265, 268, 122 or 124 of these regulations or to the notification requirements of 7* ***Del.C.*** *§§6304, 6306 & 6307, until it exits the unit in which it was generated, unless the unit is a surface impoundment, or unless the hazardous waste remains in the unit more than 90 days after the unit ceases to be operated for manufacturing, or for storage or transportation of product or raw materials."*

Bloom's November 21, 2014 response provides a narrative describing that natural gas from the pipeline contains sulfur compounds, including mercaptan, which are detrimental to the solid oxide fuel cell used to generate electricity. As such, Bloom subjects the pipeline natural gas to "gas purification," in which the natural gas is run through a desulfurization container to remove impurities, including sulfur, moisture, siloxanes, volatile organic compounds, and metals. The impurities adsorb to the sorbent's pores or chemically bond to the surface of the sorbent in the canister. When the sorbent can no longer remove impurities, the canister is removed from the fuel cell module and shipped to Unicat Services in Alvin, Texas. Bloom believes the spent sorbent is exempt from regulation in Delaware, as the exemption in DRGHW § 261.4(c) states the waste is exempt from regulation until removed from the manufacturing process unit. In justifying that the desulfurization canisters are considered a manufacturing process unit, Bloom states that, "*The desulfurization canisters/tanks are [an] integral part of the electrical manufacturing processing and critical to the fuel cells by removing Sulfur that is poisonous to the fuel cell contained in the gas feedstock.*" The response goes on to read:

> *"The desulfurization canisters / tanks are located in the Fuel Processing Module (FCM) within the Input / Output module of the energy servers. The desulf canisters / tanks are designed and operated to hold valuable raw materials in during electricity manufacturing and transportation or storage. Desulfurized gas from the canisters/tanks is then piped into Fuel Cell Module (FCM) located within the Power Module (PWM). Because of their design, structural integrity, and operation, these canisters/tanks are capable of holding, and are typically operated to hold the potential hazardous wastes which are generated in them until the wastes are purposefully removed. Thus, if there are hazardous wastes, they are contained against release into the environment."*

The SHWMS does not concur that the manufacturing process unit exemption applies to this situation. In its preamble to the final rule (45 FR 72025), EPA stated:

> *"Except for surface impoundments, and non-operating units, EPA did not intend to regulate product and raw material storage tanks, transport vehicles and vessels or manufacturing process units in which hazardous wastes are generated. As represented by the above examples, most of these units are tanks or tank-like units (e.g., distillation units) which are designed and operated to hold valuable products or raw materials in storage or transportation or during manufacturing."*

EPA also states the exemption is applicable to those units "*operated for the primary purpose of manufacturing or product or raw materials storage or transportation.*" The basis of the exemption is that a manufacturing process unit simultaneously holds both a raw material or product in addition to a hazardous waste.

In a separate guidance document, EPA provides an example of a situation to which the manufacturing process unit would apply:

> *"A manufacturing process unit that makes chemical coatings generates a sludge in the same tank where manufacturing of chemicals is conducted. The sludge is characteristic but remains in the tank for several months and is not removed until the unit ceases operation (before 90 days after the unit ceases operation). The sludge is not a regulated hazardous waste until it is removed from the tank."*

The sorbent material is neither a product that is being manufactured by Bloom, nor is it a raw material being used in the manufacturing process. Further, there is no manufacturing occurring in the desulfurization canister.

Further, in a guidance document dated May 1990 (RO13374), EPA states:

> *"Although the exemption is available for hazardous waste in transport vehicles and vessels, which may be moved to a central facility for cleaning (see 45 FR 72026, October 30, 1980), EPA does not interpret the exemption as applying to manufacturing process units, associated non-waste treatment units, or product/raw material storage tanks (that are stationary during operation) if those units are disassembled for cleaning off-site."*

Given no manufacturing occurs in the desulfurization canister and the canister is removed from the fuel cell module for off-site processing, the SHWMS concludes the manufacturing process unit exemption does not apply. Therefore, once the sorbent material can no longer effectively capture sulfur, it meets the definition of a spent material, which is defined in DRGHW 261.1(c) as:

> *"any material that has been used and as a result of contamination can no longer serve the purpose for which it was produced without processing."*

A spent material being reclaimed is a solid waste, as identified in Table 1 of DRGHW § 261.2. As such, the waste is required to be managed in accordance with all applicable provisions of DRGHW upon generation of the waste (i.e., when the sorbent material becomes spent and can no longer effectively capture sulfur).

As Bloom has not been managing this waste stream as hazardous waste upon generation, several violations have been incurred. These include, but are not limited to the violations cited below. Bloom failed to make a hazardous waste determination at the time of waste generation. This is a violation of DRGHW § 262.11, which reads:

> *"A person who generates a solid waste, as defined in §261.2, must determine if that waste is a hazardous waste using the following method:*
>
> *(a) He should first determine if the waste is excluded from regulation under §261.4.*
>
> *(b) He must then determine if the waste is listed as a hazardous waste in Subpart D of Part 261.*
>
> ***Note**: Even if the waste is listed, the generator still has an opportunity under Part 260, Subpart C to demonstrate to the Secretary that the waste from his particular facility or operation is not a hazardous waste.*
>
> *(c) For the purpose of compliance with Part 268, or if the waste is not listed in Subpart D of Part 261, the generator must then determine whether the waste is identified in Subpart C of Part 261 by either:*

> *(1) Testing the waste according to the methods set forth in Subpart C of Part 261, or according to an equivalent method approved by the Secretary under Part 260, Subpart C, or;*
> *(2) Applying knowledge of the hazard characteristic of the waste in light of the materials or the processes used.*
> *(d) If the waste is determined to be hazardous, the generator must refer to Parts 261, 264, 265, 266, 268 and 273 of these regulations for possible exclusions or restrictions pertaining to management of the specific waste."*

Bloom also shipped the spent sorbent to Unicat Services in Alvin, Texas without using a hazardous waste manifest on, at a minimum, July 16, 2014, July 29, 2014, and September 4, 2014. This is a violation of DRGHW § 262.20(a)(1), which reads:

> *"A generator who transports, or offers for transportation, hazardous waste for off site treatment, storage, or disposal, or a treatment, storage, and disposal facility who offers for transport a rejected hazardous waste load, must prepare a Manifest (U.S. OMB Control Number 2050 0039) on EPA Form 8700 22 and, if necessary EPA Form 8700 22A, according to the instructions included in the appendix to this part."*

Additionally, Unicat Services in Alvin, Texas is not a permitted treatment, storage, or disposal facility (TSDF), but is rather a large quantity generator that is owned by Bloom Energy. Additionally, the waste was transported by a common carrier broker, Expediters, Inc., who is not in possession of a hazardous waste transporter permit in Delaware. Failing to send hazardous waste to a permitted TSDF is a violation of DRGHW § 262.12(c), which reads:

> *"A generator must not offer his hazardous waste to transporters that have not received an EPA identification number and a Delaware hazardous waste transporter permit or to treatment, storage, or disposal facilities that have not received an EPA identification number."*

Bloom Energy also failed to obtain an EPA identification number for its Delaware location, which is a violation of DRGHW § 262.12(a), which reads:

> *"A generator must not treat, store, dispose of, transport, or offer for transportation, hazardous waste without having received an EPA identification number from the Secretary."*

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